

WHAT IS CLAIMED IS:

1. A projection optical system for projecting a pattern of a first object onto a second object, characterized in that said projection optical system  
5 is provided with birefringence correcting means for correcting birefringence of an optical element of said projection optical system.

2. A projection optical system according to  
10 Claim 1, wherein said birefringence correcting means comprises at least one optical member having predetermined form birefringence.

3. A projection optical system according to  
15 Claim 2, wherein said at least one optical member is arranged so that a distribution, including a distribution of form birefringence produced by said at least one optical member, is effective to cancel the birefringence to be produced by an optical element of  
20 said projection optical system.

4. A projection optical system according to Claim 2 or 3, wherein said at least one optical member is arranged to produce form birefringence on the basis  
25 of a diffraction grating having a period smaller than a wavelength used.

5. A projection optical system according to  
Claim 4, wherein said diffraction grating is provided  
on the surface of the optical element of said  
projection optical system.

5

6. A projection optical system according to  
Claim 1, wherein said birefringence correcting means  
comprises at least one optical member having a  
predetermined stress distribution.

10

7. A projection optical system according to  
Claim 6, wherein said at least one optical member is  
arranged so that a distribution, including a  
distribution of stresses produced by said at least one  
optical member, is effective to cancel the  
birefringence to be produced by an optical element of  
said projection optical system.

15

8. A projection exposure apparatus, comprising:  
an illumination system for illuminating a  
first object with light; and  
a projection optical system as recited in any  
one of Claims 1 - 7, for projecting a pattern of the  
first object illuminated with the light from said  
illumination system, onto a second object for exposure  
of the same.

20

25

9. A projection exposure apparatus, comprising:  
illuminating means for illuminating a first  
object with slit-like light;

scanning means; and

5 a projection optical system as recited in any  
one of Claims 1 - 7, for projecting a pattern of the  
first object onto a second object while the first and  
second objects are simultaneously scanned in a  
widthwise direction of the slit-like light, at a speed  
10 ratio corresponding to a projection magnification of  
said projection optical system.

10. A device manufacturing method including a  
process for printing a device pattern on a substrate  
15 by use of a projection exposure apparatus as recited  
in Claim 8 or 9.

20

25